Device for applying liquid to a running web

The invention relates to a device for applying liquid to a running web, in particular for applying dyeing liquid to a textile web having a pile, for example a carpet web.

It is known that textile pile fabrics can be dyed in two different ways:

a) In what is called the pouring method, dyeing liquid is poured usually from above onto the surface of the pile. The pouring method is suitable in particular for light carpets, those with a hollow structure, and for raised fabrics.

b) In what is called the injection method, dyeing liquid is injected at high pressure into the volume. To do this, the running web is pressed against the application means such that the pile is compressed as it passes the application means. The injection method is suitable in particular for heavy carpets and loop fabrics.

It has been found in practice that the two conventional methods have their limits, especially in cases where a considerable variation in the depth of the color is intended to be achieved across the running web. Thus, for example in conventional pouring apparatus, the ratio between the minimum and the maximum application quantity is about 1:3.5.

Therefore, the object of the invention is to make available a device with which it is possible to vary the ratio between the minimum and maximum application quantity, without in so doing having a negative impact on the uniformity of the application of the dye.

This object is achieved by the device set forth in claim 1.

The fact that the device is configured in such a way that it can be alternately operated in injection mode, in which the liquid is delivered at high pressure to the volume of the web, or in pouring mode, in which the liquid is applied to at least one surface of the web, means it is possible to switch between the methods during operation. Tests have shown that the ratio between the minimum and the maximum quantity of dye to be applied can be increased to 1:10.

With the device according to the invention, it is possible to carry out both the methods cited under a) and b) above. It is therefore possible to be able to react to changing market demands. Moreover, the device according to the invention takes up less space than the two devices that are otherwise needed. A further important advantage of the device according to the invention is the considerable cost savings, since only one dye preparation is needed for both methods. In addition, it is possible to make savings in terms of the component parts, such as control elements, etc., that previously had to be present for each device.

The device according to the invention preferably comprises a web guide means with which the web is guided under the application means.

A design variant of the device according to the invention is particularly preferred in which the distance between the application means and the web guide means is variable. It is then easy to switch between the injection method and the pouring method by altering the distance. A small distance between the application means and the web guide means results in a compression of the pile, and the liquid is thus

delivered and injected into the volume of the pile. If the distance is increased, the degree of compression of the pile first decreases, until finally it no longer touches the application means, and liquid is applied in a purely pouring mode onto its surface. It is particularly advantageous that the device according to the invention also permits a form of "mixed operation" in which a distance between the application means and the web guide means is chosen which causes only a relatively slight compression of the pile and thus only a small amount of injected liquid.

The application means and web guide means preferably extend across the entire width of the web. This configuration ensures a uniform processing of the web across its entire width.

The application means and web guide means are preferably arranged approximately perpendicularly one above the other, since in this way it is possible to achieve the best possible effects in terms of uniform application of liquid.

In a particularly preferred embodiment of the device according to the invention, the distance between the application means and the web guide means can be varied by virtue of the fact that the web guide means can be adjusted in height. This has the advantage that the considerably larger application means, which is also attached to external devices via a plurality of supply lines, can be stationary.

In a preferred variant of the device according to the invention, the application means comprises a liquid chamber extending transversely with respect to the running direction of the web. Liquid is filled, preferably continuously, into this chamber from a liquid source during operation of the device, such that the filling level in the liquid chamber is

approximately constant and a uniform pressure is established.

At its base, the liquid chamber can have bores whose cross section is smaller than the cross section of the liquid chamber.

In a preferred design variant, the bores communicate with an application slit which extends transversely with respect to the running direction of the web and from which a film of liquid is intended to emerge that is as uniform as possible across the entire width of the web.

In order to unite the individual jets emerging from the bores so as to form the liquid film, there is provided, between the application slit and those ends of the bores opening into it, a baffle surface which is oriented obliquely with respect to the direction of flow of the liquid emerging from the bores.

Tests have shown that the action of the baffle surface is particularly effective when it encloses an angle of approximately 45° with the direction of flow of the individual jets.

If the area of the baffle surface comprises a plurality of webs arranged at a constant spacing from one another, such that the baffle surface is divided into a plurality of channels, lateral deviation of the liquid is prevented especially in injection mode. It is particularly preferred if the number of the channels corresponds to the number of bores, that is to say each bore opens into one of these channels.

The device according to the invention can be easily adapted to different web widths by providing means with which the effective application length of the application slit can be varied. These means preferably

comprise a shut-off slide that can alternately be pushed laterally into the liquid chamber and which ensures that a predetermined number of the bores are sealed.

Particularly when the device is driven in injection mode, in which the web comes to bear on the application head, the bearing side thereof becomes worn as a result of friction. In a particularly preferred embodiment of the device according to the invention, the application means therefore has a separate application plate on the side directed toward the web, which application plate can be replaced on reaching its limit of wear.

Maintenance and cleaning work to be performed on the application head is made considerably easier if the application plate is articulated with one of its long edges on the application means via a hinge whose hinge axis is oriented parallel to the longitudinal direction of the liquid chamber. After release of the application plate, the latter can then be swiveled about the hinge axis in order then to permit access to the long chamber.

To be able to vary the pressure of the web on the application means within a wide pressure range, in other words to be able to switch steplessly between the "pure" injection mode and the "pure" pouring mode, the web guide means, in a preferred embodiment of the device according to the invention, is designed as a flexible pressing element over which the web is guided. It preferably comprises a pneumatic support element, since in this way it is possible to ensure that the web is pressed uniformly across its entire width onto the application means. To adjust the pressure required for the desired processing result, all that then needs to be done is to vary the pneumatic pressure acting on the support element.

An illustrative embodiment of the device according to the invention is shown in the drawing, in which:

Fig. 1 is a schematic view of the device seen transversely with respect to the running direction of the web;

Fig. 2 is an enlarged representation of the same view of this device during operation;

Fig. 3 shows a view, corresponding to Fig. 2, of the same device, but with the web guide means lowered, and the application means having its application plate pivoted aside for cleaning purposes;

Fig. 4 shows an enlarged representation of the application means in cross section in its operating position;

Fig. 5 shows a view, corresponding to Fig. 4, of the application means in its position for maintenance;

Fig. 6 shows a plan view of the first part of the application plate containing the bores (view A in Fig. 7);

Fig. 7 shows a cross section through the first part of the application plate along section line VII-VII in Fig. 6;

Fig. 8 shows a side view of the second part of the application plate containing the baffle surface (view B in Fig. 9);

Fig. 9 shows the second part of the application plate in a plan view (view C in Fig. 8);

Fig. 10 shows the detail A from Fig. 9;

Fig. 11 shows the cross section B - B from Fig. 9;

Fig. 12 shows the detail C' from Fig. 8; and

Fig. 13 shows a partially sectioned side view of the device according to the invention (view D in Fig. 2).

In the drawing, the device for applying liquid to a running web is designated in its entirety by reference number 100 and comprises a crosspiece 1 on which an application means 2 is arranged which serves to apply the liquid to a running web B that is moved underneath it in the direction of arrow P. Liquid from an external source is supplied to the application means 2 via a distributor during operation, so that the filling level in the application means 2 remains more or less constant.

The web B is guided by a web guide means 3 which can be moved to and fro between an upper operating position, shown in Fig. 2, and a lower rest position, that can be seen from Fig. 3. In the upper operating position of the web guide means 3, the liquid is applied to the web B; in the lower rest position, the application means 2 can be serviced, as will be explained in more detail below.

The web guide means 3 comprises a pneumatic element 7 arranged on its top face 4. A support tube 7, 7'' is arranged on each side of the pneumatic element. The arrangement of pneumatic element 7 and support tubes 7'' is spanned by a flexible belt 5. The top face 6 of the belt 5 forms a lower contact face for the running web B. By vertical displacement of the web guide means, the vertical position of the top face 6 of the belt 5 can be altered to the extent that the device can be

changed from injection mode, in which the web is pressed against the bottom face 8 of the application means 2, and a pouring position, in which the web at best lies "loosely" on the surface of the application means. By means of the possibility, not shown in the drawing, of being able to change the pneumatic pressure in a stepless manner via a controllable compressor, and the additional possibility of being able to move the web guide means 3 vertically, it is possible to obtain any desired intermediate state between the "pure" injection mode and the "pure" pouring mode, as a result of which the device according to the invention is suitable for handling a very wide variety of web qualities.

The structure of the application means will now be explained in detail with reference to Figures 4 to 12.

As will be seen from Figures 4 and 5, which show the application means in its operating position (Fig. 4) and in its position for maintenance work (Fig. 5), the application means is made up of several parts. It comprises two parts 9, 10 which are divided by a separating surface 11 extending substantially vertically. The parts 9, 10 are secured to one another with the aid of screws 12. The parts 9, 10 are sealed relative to one another by a seal 14 fitted into a groove 13. In their lower area the parts 9 and 10 form between each other a liquid chamber 15, which is supplied with liquid via an arrangement of tubes and valves 16.

Toward the bottom, the liquid chamber 15 is covered by the first part 17 of an application plate 18 which is shown in detail in Figures 6 and 7. It comprises a plurality of closely adjacent bores 19 which, with their upper end, communicate with the liquid chamber 15. Their cross section is smaller than the cross section of the liquid chamber.

The first part 17 of the application plate 18 is again fastened by screws 20, 21 onto the parts 9, 10 of the application means 2. Seals 25, 26 fitted in grooves 23, 24 provided on both sides of the liquid chamber 15 serve for sealing relative to the bottom face 22 of the parts 9, 10.

The application plate 18 moreover comprises a second part 27 which is fitted in a recess 28 of the first part 17 and is fastened onto this with screws 29.

The second part 27 of the application plate 18 comprises an oblique baffle surface 30 (see in particular Fig. 12) divided into individual channels 32 by a plurality of webs 31. The number and arrangement of the webs 31 is chosen such that each channel 32 formed between them communicates with a bore 19.

Below the webs, the second part 27 comprises a recess 38 which, together with the opposite wall of the first part 17, forms an application slit 39 (see Fig. 5) which serves to form a thick film of liquid that is more or less uniform along its length.

A seal 34 fitted in a groove 33 in turn serves for sealing the first part 17 and the second part 27.

As can be seen in particular from Fig. 5, the application plate 18, at its right-hand edge as seen in this figure, is connected to the part 10 of the application means via a hinge 35. After loosening of the securing screws 20, the application plate 18 can thus be pivoted about the hinge axis S by the angle α, in order in this way to free the liquid chamber 15 for maintenance or cleaning purposes.

As is shown in Fig. 13, the effective length of the application head can be reduced by a shut-off slide 36,

the latter being able to be inserted laterally by the desired length into the liquid chamber 15 and shut off the bores that are covered by it. To save space, the shut-off slide 36 is guided in a rail arrangement 37 which is deflected upward by an angle of 90° in the machine frame.

List of reference numbers

1	crosspiece
2	application means
3	web guide means
4	top face
5	belt
6	top face
7	pneumatic element 7, 7'' support tube
8	surface
9	part
10	part
11	separating surface
12	screw
13	groove
14	seal
15	liquid chamber
16	supply tubes
17	first part
18	application plate
19	bore
20	screw
21	screw
22	bottom face
23	groove
24	groove
25	seal
26	seal
27	second part
28	recess
29	screw
30	baffle surface
31	webs
32	individual channels
33	groove
34	seal
35	hinge
36	shut-off slide

	37	rail arrangement
	38	recess
	39	application slit
	100	device
5	P	arrow
	B	web
	S	hinge axis